

REMARKS

Claims 21-23 and 25-53 are pending. Applicants request reconsideration based upon the following remarks.

A. Reconsideration of Rule 131 Declaration

The Rule 131 Declaration is believed to overcome the primary reference to Bai et al. and it is submitted that the statements in the Advisory Action responding to that Rule 131 Declaration are legally incorrect.

To place applicants' explanation and arguments in context, it should be appreciated that the presently pending independent claims (21 and 48) recite methods and, as the Bai et al. reference is applied by the Examiner, the Bai et al. reference fails to disclose or teach the last clause of those independent claims. (It is for this reason that all the claims were rejected on a combination of references.). The last clause of these two independent claims is now clause "c"; the last clause was "d" prior to the present amendment. Applicants' understanding of this aspect of the rejection is based upon the Office Action of November 30, 2001, at page 4, first full paragraph.

Taking first the two independent claims, in order for applicants to swear behind the Bai et al. reference, applicants do not have to demonstrate reduction to practice of the entire invention of the independent claim, but only so much of the claimed invention as the reference happens to show. In re Stempel, 113 U.S.P.Q. 77, 81 (CCPA 1957); In re Stryker, 168 U.S.P.Q. 372 (CCPA 1971). In other words, it does not matter for the purpose of the Rule 131 Declaration whether the reduction to practice relied upon in Exhibit A did or did not use plasma annealing of the layer of metal nitride. Rather, the applicants need only show the reduction of practice of steps a and b (of the claims as now presented) prior to the reference date. Since the showing demonstrates

reduction to practice of those two clauses (a and b) for each of independent claims 21 and 48 prior to the reference date, and this does not appear to be disputed in the Advisory Action, then the applicants have appropriately sworn behind the primary reference with respect to the two independent claims. Thus the rejection as to the independent claims should be withdrawn.

The next question is whether any of the dependent claims are properly supported by the Rule 131 Declaration. The Court in In re Stryker, 168 U.S.P.Q. 372, 372 (CCPA 1971) addressed this situation with the following language:

To hold that [the reference] is not removed by the showing here presented would lead to an anomalous result, i.e., if appellant broadened his claims by deleting the [weight] limitations, so as to read literally on [the reference], then [the reference] would not be available as a reference against such broadened claims because appellant's affidavit would be satisfactory in every respect. It cannot be the law that the same affidavit is insufficient to remove the same reference applied against the slightly narrower claims presented here. (Emphasis added).

Therefore, since the declaration is sufficient to remove the reference relative to the broadest claims, it is sufficient to remove the reference as to the narrower claims as they relate to features such as metal nitride layer thickness. See also In re Spiller, 182 U.S.P.Q. 614 (CCPA 1974) where the Rule 131 affidavit was sufficient although neither commensurate with the reference nor with the rejected claim.

Therefore, as a legal matter, it is submitted that the showing is sufficient for the broader claims and is sufficient for the dependent claims and accordingly the principal reference should be considered to have been antedated and all rejections based thereon should be withdrawn.

B. Rejections Based Upon Prior Art

Independent of the foregoing, applicants respectfully traverse the rejections based upon the prior art. In this situation, the Office Action does nothing more than "find" or "locate" each step in the prior art and conclude that the combination of those steps would have been obvious. However, in doing so it is submitted that the Office Action is proceeding contrary to the primary

reference (when the primary reference to Bai et al is considered as a whole) and thus the rejection is improper.

In the Bai et al. reference, the lower or capturing layer (36 in Fig. 3) may be deposited by sputtering and thereafter annealed (column 7, lines 26-29). As to the embodiment in Figs. 4A-4D, the lower or capturing layer may be deposited by sputtering or by chemical vapor deposition. (column 8, lines 36-47).

Further, in the Bai et al. reference, the upper or blocking layers (31 in Fig. 3) 42 in Figs. 4A-4D) is deposited by sputtering and subsequently annealed (column 5, lines 49-56) or by chemical vapor deposition (*Id., with no comment about annealing*) As to the embodiment in Figs. 4A-4D, deposition is by sputtering or chemical vapor deposition(column 8, lines 36-47). Thereafter, for the embodiment of Figs. 4A-4D, the capturing and blocking layers are subjected to a high temperature process to anneal the barrier. (col. 8, lines 58-61)(emphasis added) and in another embodiment there is no annealing. (column 8, line 67- column 9, line 3).

Thus the teaching of Bai et al, if read in a vacuum, is no annealing at all, or annealing both the capturing and blocking layers. Further, while Bai et al refers to plasma etching, there is no suggestion of plasma annealing, even though plasma annealing of metal nitrides, *per se*, was known in the art prior to the Bai et al filing date, as evidenced by the Hower et al. reference cited by the Examiner.

But, when read in the context of the prior art at the time of the Bai et al reference (e.g., the Hower et al reference) the teachings of the Bai et al. reference taken as a whole are that (a) the annealing step is optional, (b) where annealing is performed both of the layers are annealed, and (c) although plasma annealing was known in the prior art, it is never suggested by Bai et al, even though a plasma process (etching) was suggested by Bai et al (albeit for a different purpose).

Against this background, two things are apparent. First, the claims does not recite annealing of both layers but only plasma annealing of the metal nitride layer. This is contrary to Bai et al. Second, it would not be obvious to use plasma annealing in the method of the Bai et al. since that reference, while knowledgeable about the manufacture of interconnects in general and the use of plasma etching, and even though plasma annealing was part of the prior art, no mention is made in the reference about plasma annealing.

Thus, while the Examiner concludes that plasma annealing would have been obvious, the evidence of record indicates that something “known” at the time of Bai et al., plasma annealing, was certainly not mentioned by Bai et al. and it is equally likely that it was not obvious and/or that it was thought of and rejected by Bai et al. In short, based upon the references themselves, the combination of references as applied by the Examiner is merely a hindsight picking and choosing of method steps to match up to the claims.

Based upon the foregoing, reconsideration of the prior art rejection is solicited.

C. Rejection Under Section 112

The claims have been amended to respond to this rejection and it is submitted that the claims as now presented comply with the requirements of 35 U.S.C. § 112.

CONCLUSION

For each of the foregoing reasons, reconsideration and allowance are respectfully solicited. Should the Examiner believe that a conference would expedite the prosecution of this application, the Examiner is encouraged to call applicants attorney at the telephone number given below.

Respectfully submitted,

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MARKED-UP COPY OF AMENDED CLAIMS

21. (Thrice Amended) A method for forming a structure in an integrated circuit, said structure extending from a conductive surface through a channel having inner walls extending above said conductive surface, said method including the steps of:

(a) depositing a layer of a refractory metal on said conductive surface and said inner walls of said channel;

(b) forming a layer of metal nitride on said layer of said refractory metal, wherein said layer of said metal nitride has a thickness extending from said layer of said refractory metal of less than 130 Å;

[(c) said metal nitride layer being of greater thickness than said layer of refractory material;] and

[(d)] (c) plasma annealing said layer of metal nitride.

48. (Twice Amended) A method of forming a barrier layer over a conductive surface surrounded by a channel having inner walls extending above said conductive surface, said method including the steps of:

(a) depositing a layer of a refractory metal on said conductive surface and said inner walls of said channel to a thickness in a range of about 25 to 100 Å;

(b) depositing a layer of a metal nitride on said layer of said refractory metal;

[(c) said metal nitride layer being of greater thickness than said layer of refractory material;] and

[**(d)**] **(c)** plasma annealing said layer of said metal nitride, wherein said layer of said metal nitride has a thickness extending from said layer of said refractory metal of less than 130 Å after completing said step (b).